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SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
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INDUSTRIAL ENGINEERING
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American Shipbuilding Quality Standards Vol. 3 Coatings

U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

in cooperation with
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American Shipbuilding Quality Standards

VOLUME 1 HULL

VOLUME 2 OUTFITTING

VOLUME 3 COATINGS

National Shipbuilding Research Project

6-97-1

June 1999

Preface

To achieve success in ship construction, it is necessary for the ship owner and the ship builder to agree on the level of quality in the final product. Classification rules, regulatory requirements, and ship specifications all help to define an acceptable level of construction quality; however, this guidance alone is not sufficient. Therefore, it is up to the shipbuilder to sufficiently describe the level of workmanship that will be reflected in the delivered ship and for the ship owner to effectively communicate his expectations for the final product.

It is the intent of this document to contribute to these objectives in the following ways:

1. To describe a reasonable acceptable level of workmanship for commercial vessels built in the United States.
2. To provide a baseline from which individual shipyards can begin to develop their own product and process standards in accordance with generally accepted practice in the commercial marine industry.
3. To provide a foundation for negotiations between the shipbuilder and the ship owner in reaching a common expectation of construction quality.

The acceptance criteria herein are based on currently practiced levels of quality generally achieved by leading international commercial shipbuilders. These criteria are not intended to be a hard standard with which all U.S. shipyards must comply. Rather, they are intended to provide guidance and recommendations in the key areas that play a major role in customer satisfaction and cost-effective ship construction.

The project that resulted in this standard was developed by the National Shipbuilding Research Program's Marine Industry Standards Panel as part of its charter to promote the value of standardization in commercial ship construction.

Scope

This standard consists of three volumes: Hull, Outfitting, and Coating. The subjects of these volumes were selected for several reasons. First, the leading commercial shipbuilding nations already have in place widely recognized standards of expectations in these areas. These constitute the most significant areas where workmanship is a critical factor in customer satisfaction. And last, the cost associated with the labor involved in these three areas is a significant factor in construction manhours and overall schedule.

The standard criteria provided in this document are intended to apply to conventional, commercial ship construction. In many cases, specialized, non-conventional vessels using

non-standard materials or built to serve sole requirements may require unique acceptance criteria that are beyond those provided in this document.

Finally, the National Shipbuilding Research Program in funding the development of this standard considers this product to be a start in the development of commercially competitive ship construction standards and techniques, not an end in itself. As U.S. competitiveness in this market segment matures, and as owner expectations evolve, these criteria should be revised to reflect these changes. Only with the proper upkeep and maintenance will this effort be a worthwhile investment in the future competitiveness of the U.S. shipbuilding industry.

American Shipbuilding Quality Standards

VOLUME 3

COATINGS

National Shipbuilding Research Project

6-97-1

ASQS - FOR COATINGS

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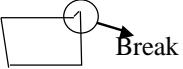
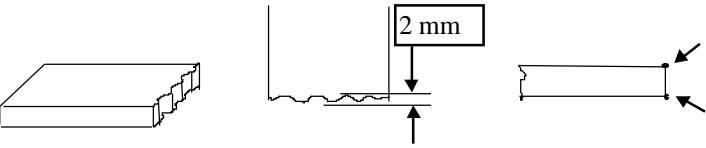
I. Introduction

This American Quality Shipbuilding Standard for Coatings addresses those aspects of coating application inherent in achieving finished product quality that can be measured and warranted as meeting acceptable criteria. Due to the nature of coating systems, where preparation and methodology directly affect finished quality, this standard contains information about processes and application practices, as well as pass/fail criteria of the end product. It should be acknowledged that measuring finished coating attributes cannot determine that good application practices were followed. Therefore, they cannot be used as a sole means of warranting the finished quality of the coating.

II. General

No.	Item	Prerequisites	Remarks
1	Type of Vessel	Commercial and Military	
2	Tank Coating Area	No Limitation	
3	Type of cargo	Products identified in the specification section.	Refer to ship's specification
4	Tank anodes	In accordance with ship's specifications in Water Ballast Tanks and Slop Retention Tank.	Refer to ship's specification
5	Outfitting	In the case of steel, painting is similar to the surrounding area. Paint shall not be applied to woodwork, polished fittings, gaskets, packing, anodes, non-ferrous material, or other non-corrosive metals and any other surface or fittings and equipment where paint could obstruct their proper function.	
6	Paint to be used	As specified by owner. Coatings shall be lead free, chromate free, asbestos free, cadmium free and comply with applicable Federal, State and local Regulations	Refer to ship's specification
7	Dry film thickness	Refer to ship's specification and manufacturer's recommendations.	Refer to ship's specification
8	Shop primer	After primary surface preparation, one (1) coat of inorganic zinc silicate type shop primer will be applied in accordance with the paint manufacturer's recommendation, for structural steel not coated with inorganic zinc silicate type shop primer builder shall blast to SSPC-SP 10 and apply first coat of specified system, subject to owner approval. Surface profile to comply with ship's specification.	
9	Holding coat	As determined by builder with consideration to paint manufacturer's recommendation.	
10	Painting Process	Block unit through completion.	

III. Pre-Surface Preparation Standards

No.	Item	Process Standard	Judgment	Remarks
11	Free edge In Immersion Service Areas To Be Coated	(1) Break 90 degree edges 1 mm minimum. (2) In general, rolled angle edges, bulb flats, etc. (including flat bars) are to be left untreated.		Visual
12	Spatter In Immersion Service Areas To Be Coated	(1) For spatter observed before blasting: (a) Remove with a chipping hammer, scraper, etc. (b) For spatter not easily removable with a scraper, etc. Use grinder or disc. Note: It is the intent of this standard that all spatter is to be removed before surface prep. Any remaining or additional spatter observed after surface prep shall be removed in accordance with 1(a) and 1(b).		Visual
13	Undercut	Undercut to a depth exceeding 1.6mm and a width smaller than the depth is to be repaired by grinding. If a sharp edge exists with a crest exceeding 3mm grind until irregularity is less than 3mm.	Visual	Refer to explanation Page 8
14	Surface damage	Surface damage, pitting, break-off marks to depths exceeding 1 mm are to be repaired by welding or grinding	Visual	Refer to explanation Page 8
15	Manual welding bead	Weld beads with surface irregularities exceeding 3 mm or with a sharp crest are to be ground until the irregularity is less than 3 mm.	Visual	
16	Automatic welding bead	In general, no specific treatment is required.	Visual	
17	Overlap welding bead	Overlapping weld beads that create sharp notches are to be repaired as per item No. 13, "Undercut".	Visual	
18	Welding arc strike	Same as Item No. 12, "Spatter", and Item No. 14, "Surface Damage."	Visual	
19	Gas cut surface	Gas cut surfaces are to be ground as follows. (a) Except where hull strength considerations require a smooth finish, notches shall be ground to less than 2mm. (b) Gas slag produced during cutting is to be treated according to Item 11, "Free Edge." Treatment to be accomplished before blasting.		Visual
20	Lifting lugs	Where a lifting lug is partially removed by cutting the pad-eye portion off per page 17 of the Hull volume, the remaining stub and surrounding area is to be treated according to item No. 11 "Free Edge", item No. 15 "Manual welding bead", and item No. 19 "Gas cut surface".	Visual	

No.	Item	Process Standard	Judgment	Remarks
21	Moisture	To be removed until no visible moisture remains	Visual	Refer to Explanation Page 9
22	Oil and grease contaminants	To be removed, by wiping with thinner, fresh water (preferably high pressure wash), wire brush or compressed air or as permitted by paint manufacturer.	Visual	
23	Dust and mud contaminants	Dust and contaminants are to be removed by compressed air, vacuum or high pressure water cleaning, as necessary.	Visual Clear Tape Test Method	
24	Chalk or slate pencil marks	To be removed with rag or brush in accordance with manufacturer's recommendation.	Visual	
25	Marking paint	To be removed by blasting, power tool or other. Marking paint for epoxy does not need to be removed if it is in accordance with coating manufacturer's recommendation.	Visual	

IV. Surface Preparation Standards

No.	Item	Process Standard	Judgment	Remarks
26	Solvent Cleaning	Refer to ship's specification	Visual Standards	Refer to Explanation Page 9
27	Mechanical Cleaning	Refer to ship's specification	Visual Standards	
28	Abrasive Blast Cleaning And Surface Profile	Refer to ship's specification	Visual Standards	
29	Water Jetting	Refer to ship's specification	Visual Standards	
30	Abrasives	Refer to ship's specification	Written Standards	
31	Repairs	Refer to ship's specification	Visual Standards	

V. Coating Standards

No.	Item	Process Standard	Judgment	Remarks
32	Stripe Coating Tanks	To achieve the specified DFT, stripe coats shall be applied to: edges of small holes, corners of other flame burned edges, free edges of structural members, and rough welding seams.	Visual	Refer to Explanation Page 10

33	Overall coat	When more than one coat is specified, subsequent coats shall not be applied until preceding coat has sufficiently cured/dried in accordance with paint manufacturer's recommendation.	Wet gauge and Visual	

VI. Coating Repair Standards

No.	Item	Process standard	Judgment	Remarks
34	Sagging	Sagging with a height of 2 mm or more is to be repaired in accordance with the paint manufacturer's recommendations.	Visual	Refer to Explanation Page 11
35	Spray dust	Dry spray, over spray, and spray dust is to be removed before painting in accordance with the manufacturer's recommendations.	Visual	
36	Foreign matter	Foreign matter in the paint film shall be removed. Damaged film is to be repaired in accordance with the manufacturer's recommendations.	Visual	
37	Crater, pinholes and bubbles	Defects are to be repaired in accordance with the manufacturer's recommendations.	Visual	Refer to Explanation Page 12
38	Blushing	Excepting the final coat film, visible blushing on the film surface is to be repaired in accordance with the manufacturer's recommendations.	Visual	
39	Mechanical damage	Touch up is to be equivalent to the original specification, unless otherwise noted in the Painting Plan.	Visual	
40	Insufficient film thickness	Areas with insufficient film thickness are to be repaired in accordance with the manufacturer's recommendations.	Visual/Dry Film Gage	Refer to Explanation Page 13

VII. Film Thickness Measurement Standards

No.	Item	Process standard	Judgment	Remarks
41	Film thickness measurement of tank plate	Film thickness to be measured for every five square meters for flat panels or corrugated bulkheads. Film thickness is to be measured at two (2) points in each panel of plating bounded by transverse and longitudinal members. (Note: <i>this excludes panel breaker, or panel stiffeners</i>)	Micro tester or electro-magnetic film thickness gauge	
42	Film thickness measurement of tank longitudinal members	Film thickness to be measured at two points between transverse members on each side of web and face plates (Note: <i>this excludes panel breakers and panel stiffeners</i>)	Micro tester or electro-magnetic film thickness gauge	Refer to Explanation Page 13
43	Film thickness measurement of tank transverse members	Film thickness to be measured at three points between longitudinal girders or bulkhead on each side of web and face plates.	Micro tester or electro-magnetic film thickness gauge	

VIII. Environmental Painting Standards

No.	Item	Process standard	Judgment	Remarks
44	Temperature (During painting, and drying)	Steel and air temperatures are to be in accordance with the paint manufacturer's recommendations.	Measure with a thermometer	Refer to Explanation Page 14
45	Humidity (During painting, and initial drying)	Paint shall not be applied during periods of rain, snow, fog or mist in the open air or when ambient relative humidity exceeds manufacturer recommendation.	Measure with a hygrometer. Measure with a surface thermometer	
46	Ventilation (Immediately before blasting to paint)	Air change rate to be two times per hour, or more as directed by the manufacturer's product data sheet.	Check ventilating requirement	Refer to Explanation Pages 14, 15
47	Ventilation (During paint drying)	Air change rate to be five times per hour or more. Dehumidifying capacity to be according to ventilation requirements. If the external air humidity is above 85%, air change rate may be decreased to the capacity of the dehumidifier.	Check ventilating requirement	
48	Erection of scaffolding	Make sure that scaffolding does not interfere with painting, ventilation, illumination, blasting and inspection (builder shall attempt to maintain a 150 mm clearance wherever possible). If not possible (to maintain the 150 mm clearance), the Owner shall be informed of the particular area and review during the scaffolding inspection.	Visual	
49	Removal of scaffolding	Care must be taken not to damage the film.	Visual	Refer to explanation Page 16
50	Illumination	Effective illumination to be provided to ensure proper inspection of the blast and coated surface is achieved.	Visual	

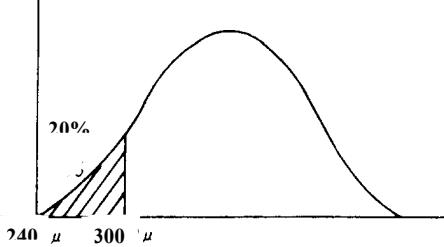
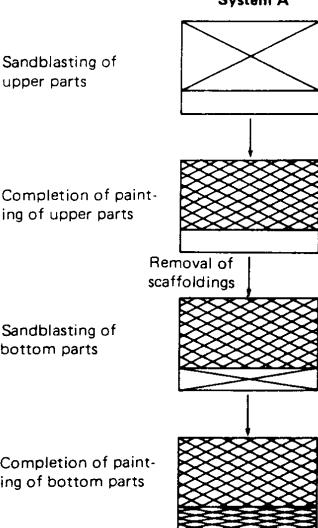
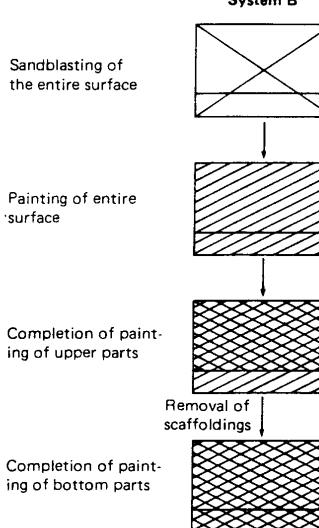
IX. Inspection Standards

No.	Item	Standard	Control		
			Owner	Shipyard	Paint Manufacturer
51	Pre-Surface Preparation	Refer to Pages 3 and 4	Δ	Δ	Δ
52	Surface Preparation	Refer to Page 4	Δ	Δ	Δ
53	Stripe Coating	Refer to Page 10		Δ	Δ
54	Film Thickness	Refer to Pages 7 and 13		Δ	Δ
55	Final Inspection	Final confirmation of completion of painting	Δ	Δ	Δ
56	Temperature Humidity and Dew Point	Refer to Page 14		Δ	Δ
57	Gas Concentration Of solvent	Refer to Page 15		Δ	Δ
58	Ventilation	Refer to Page 14		Δ	Δ

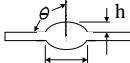
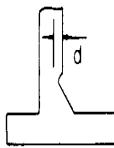
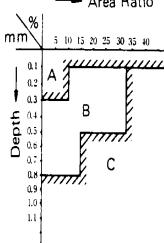
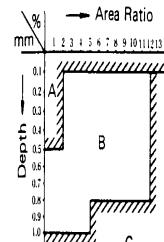
ASQS

EXPLANATIONS

II. General

No.	Item	Explanation
4	Tank anodes	<p>(1) Anodes may be installed in ballast tanks which are often loaded with sea water.</p> <p>(2) Anodes are not to be installed when dissolution of zinc into the tank contents presents problems (as in the case of jet fuel, etc.).</p>
7	Dry film thickness for Ballast Tanks, Fore/Aft Peak Tanks, Wet Spaces and Water Tanks shown. See note for all other spaces.	<p>Measurements at 80% of total measuring points must verify a film thickness exceeding or equal to a specified value (e.g., 300 microns). For the remaining 20%, the measured film thickness must be equal to or over 80% (e.g., 240 micron) of the specified thickness. (<i>Note: All other tank spaces the 90-10 rule shall apply, All other surfaces to SSPC-PA 2</i>)</p> 
10	Tank painting process (Typical; guideline only, deviations are acceptable)	<p>(1) For tank coating, block painting, painting in a dry dock, afloat painting, or any combination is considered. However this standard is based on afloat painting only.</p> <p>(2) For abrasive blasting and painting in tank, the following two systems may be considered:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>System A</p>  </div> <div style="text-align: center;"> <p>System B</p>  </div> </div>

III. Preparation Standards for Steel

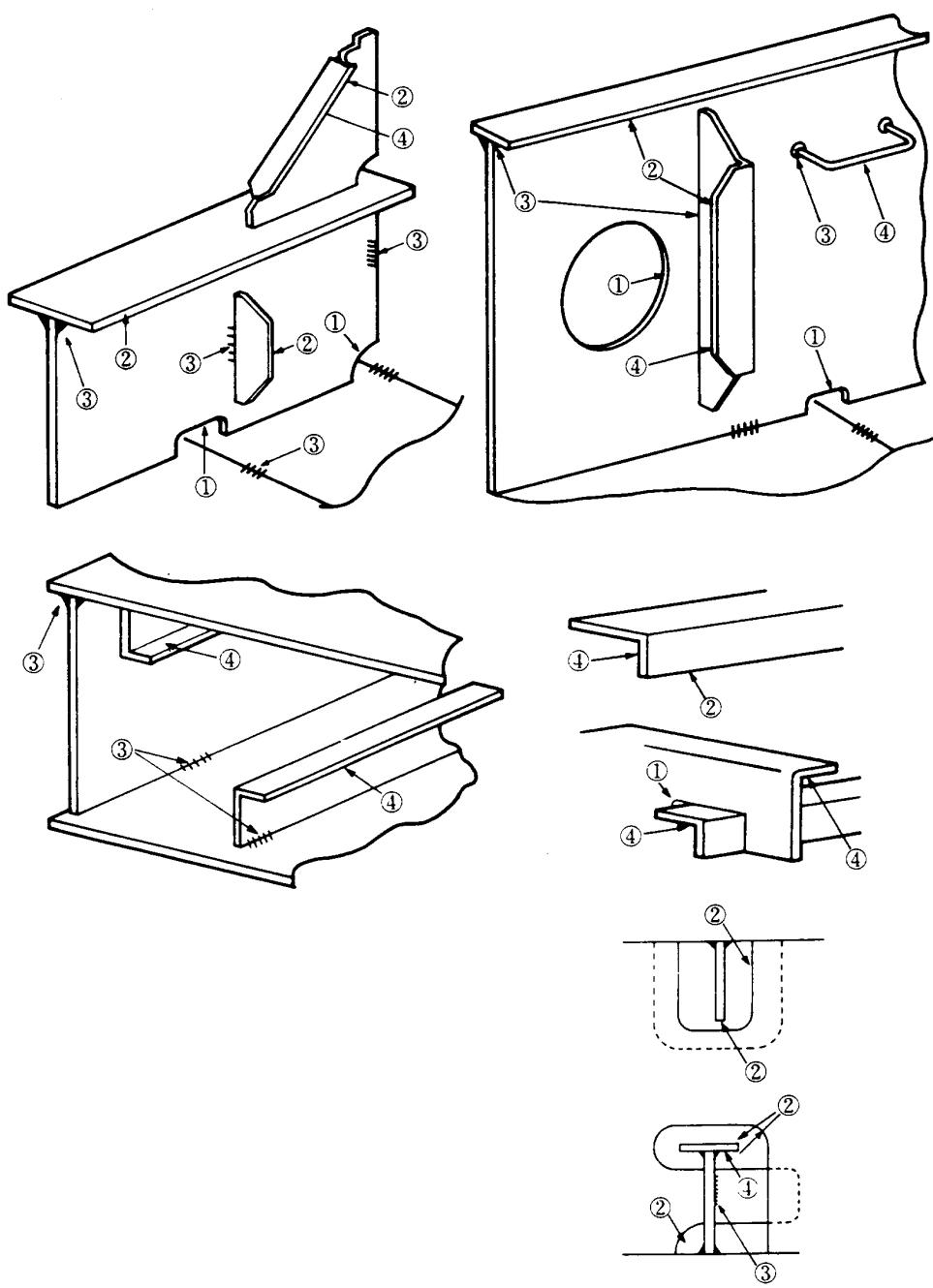
No.	Item	Explanation																														
		Division		Welding																												
section	Sub-section	Item	Tolerance Limits		Remarks																											
13	Undercut	hgt. of reinf. brth. of bead, flank of ang.	 <p>h: not defined B: not defined $\theta = 90^\circ$</p>		 <p>grinding weld up</p> <p>In cases where θ is over 90°, repair by grinding or welding to make $\theta = 90^\circ$</p>	<p>To be repaired by welding electrode or other, (carefully avoid short bead for higher tensile steels).</p>																										
		under-cut (butt weld)	Skin plate and face plate between $0.6\otimes$	Over 90 mm continuous $d = 1.6\text{mm}$																												
		under-cut fill	Others	$d = 1.6\text{mm}$																												
		leg lghth.		 <p>$d \leq 1\text{mm}$</p>																												
14	Surface damage	Division		Material																												
section	Sub-section	Item	Remarks																													
surface flaw	pit	Grade of pitting	 <p>Area Ratio (%) vs Depth (mm)</p> <table border="1"> <tr><th>Depth (mm)</th><th>Area Ratio (%)</th></tr> <tr><td>0.1</td><td>5</td></tr> <tr><td>0.2</td><td>10</td></tr> <tr><td>0.3</td><td>15</td></tr> <tr><td>0.4</td><td>20</td></tr> <tr><td>0.5</td><td>25</td></tr> <tr><td>0.6</td><td>30</td></tr> <tr><td>0.7</td><td>35</td></tr> <tr><td>0.8</td><td>40</td></tr> </table>	Depth (mm)	Area Ratio (%)	0.1	5	0.2	10	0.3	15	0.4	20	0.5	25	0.6	30	0.7	35	0.8	40	<ol style="list-style-type: none"> Grade A is considered slight and no repair is necessary. Grade B is medium and is to be repaired if necessary. Grade C requires some repair. Pitting or flaking on boundaries of grade "A" and "B", grade "B" and "C", and grade "A" and "C" shall be classified as grade "A", grade "B" and grade "A" respectively. Repair method of surface flaw: depth of defect = d, plate thickness = t ($d=.07 t$ remove by grinding (but in no case $d = 3\text{ mm}$) $.07 t = d = .2 t$ grinding followed by welding). 										
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1.2	12																															

21	Moisture	Rainwater inflow and moisture in the air may produce sweat on steel surface. After secondary surface preparation, moisture may cause turning or hinder adhesion. Appropriate measures must be taken to prevent rainwater from flowing in.
22	Oil and grease contaminants	In general, remove with a rag and thinner/cleaner. For heavy adhesion of grease and oil, first dissolve with a brush soaked in thinner/cleaner, then wipe off with a clean rag. Detect oil visually with a black light or water spray bottle (water break test).
23	Dust and non-visual contaminants	Check for dust with clear tape, clean cloth or pictorial standard in accordance with ISO 8502-3. Remove dust by compressed air or vacuum. Non-visual contaminants may be removed in accordance with SSPC-SP 12/NACE No. 5 as applicable to meet the ship's specification and manufacturer's recommendation. Check for soluble salts according to ISO 8502-6 when required by manufacturer or ship's specification.
24	Chalk or slate pencil marks	Remove with a rag or brush. When marks enter an anchor-pattern concavity and are difficult to remove, use a hard brush.

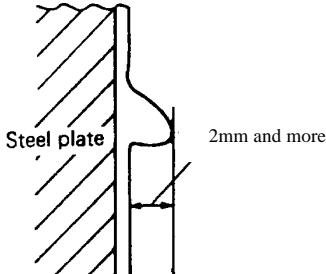
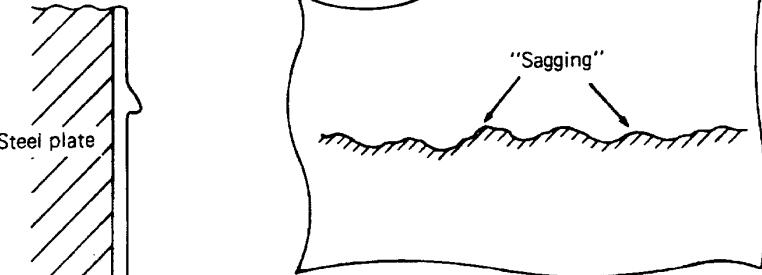
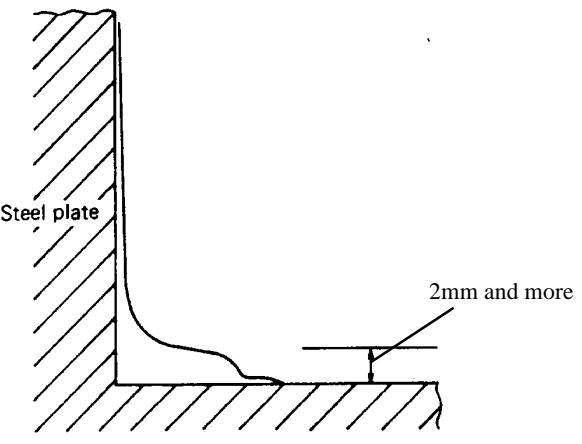
IV. Surface Preparation Standards

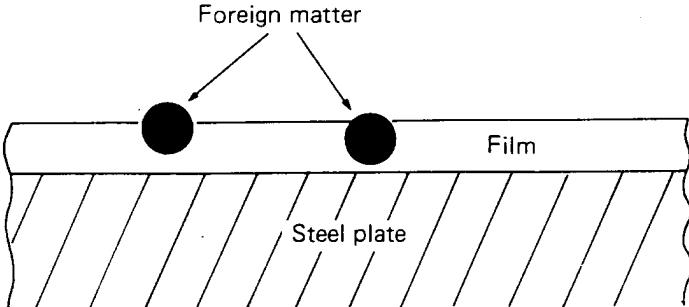
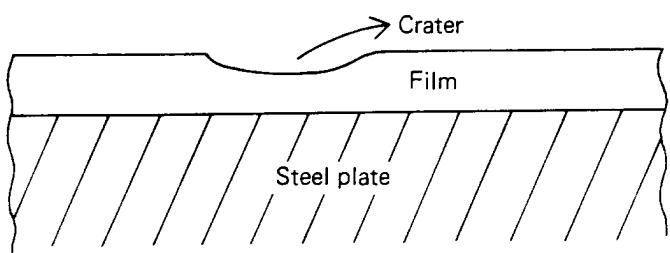
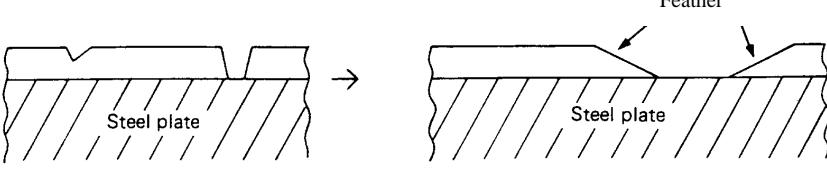
No.	Item	Explanation
26	Solvent Cleaning	Surface cleanliness is to be in accordance with SSPC-SP 1. Note: SSPC-SP 1 is required prior to all other surface preparation methods.
27 52	Mechanical Cleaning	SSPC-SP 3 is the minimum accepted method of repair for non-immersion service substrates. (SSPC-SP 2 may be substituted where SSPC-SP 3 is impractical). SSPC-SP 11 is the minimum accepted method for repair of immersion service substrates. To determine surface cleanliness, refer to the SSPC-VIS 3 photographic standard. To determine surface profile use ASTM D 4417 Method A or B.
28 52	Abrasive Blast Cleaning	SSPC-SP 10 is the minimum accepted surface preparation for pre-construction primer and for immersion service substrates. SSPC-SP 7 may be used in place of SSPC-SP 3 when practical. For cleanliness refer to SSPC-VIS 1-89 photographic standard. To determine surface profile use ASTM D 4417 Method A or B.
29 52	Water Jetting	Where acceptable according to the ship's specification and manufacturer's recommendations, clean in conformance with SSPC-SP 12/NACE No. 5. Refer to SSPC-VIS 4(1)/NACE No. 7 photographic standard. To confirm pre-existing surface profile use ASTM D 4417.
30	Abrasives	Blast surface color tends to vary depending on the abrasive material used. As long as the same grade of cleanliness is used, a difference in color does not affect the film performance. Abrasives to be determined according to SSPC-AB 1. Recycled Abrasive Cleanliness to be determined according to SSPC-AB 2.
31	Repairs to shop primed surfaces	(1) In general shop primer in the cargo oil and slop retention tanks shall be removed in accordance with manufacturer's recommendation to a visual acceptance. (2) All other spaces intact shop primer may remain and over coated in accordance with manufacturer's recommendation. (3) In no way does the above supercede the ship's specification

V. Coating Standards

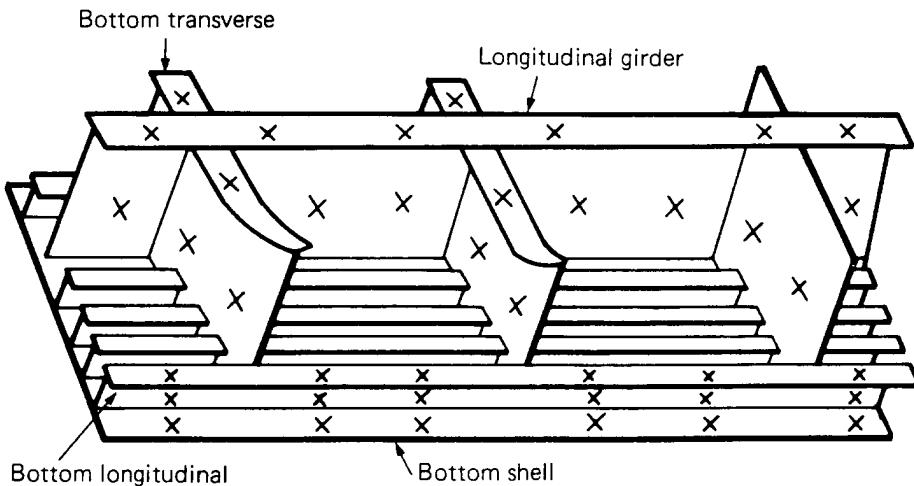
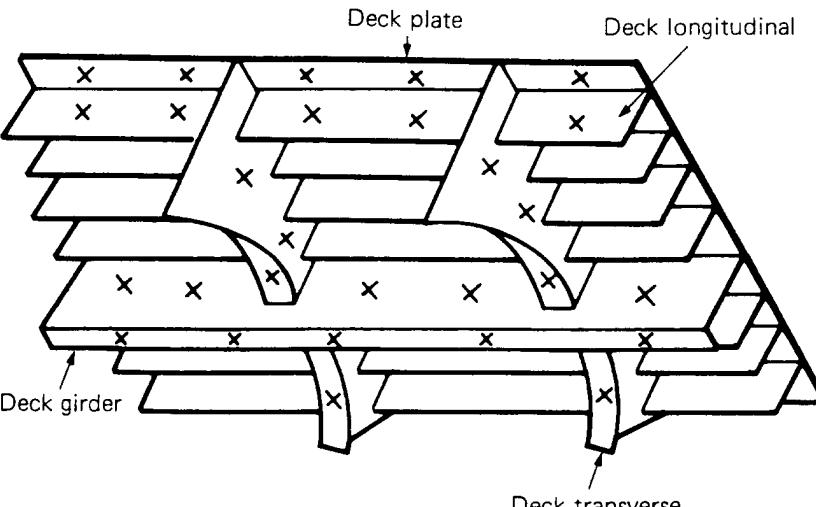
No.	Item	Explanation
32	Stripe coating in tanks.	<p>Where airless spraying is difficult and the film thickness can not be maintained, apply stripe coating with a brush before or after spraying.</p> <p>Stripe coating locations are as follows:</p> <ul style="list-style-type: none"> (a) Inside and edges of holes ① (b) Free edges ② (c) Welding beads ③ (d) Where painting is difficult ④  <p>The technical drawings illustrate stripe coating locations on various metal structures. The first drawing shows a horizontal beam with a vertical flange; areas ① through ④ are indicated along the flange and the main beam. The second drawing shows a vertical tank wall with a circular opening; areas ① through ④ are indicated along the top edge and the vertical wall. The third drawing shows a horizontal tank with a rectangular opening; areas ① through ④ are indicated along the top edge and the vertical wall. The fourth drawing shows a U-shaped bracket; area ① is indicated along the top horizontal leg, and area ④ is indicated along the vertical leg. The fifth drawing shows a T-shaped bracket; area ② is indicated along the top horizontal leg, and area ④ is indicated along the vertical leg. The sixth drawing shows a corner joint; area ③ is indicated along the top horizontal leg, and area ④ is indicated along the vertical leg.</p>

VI. Coating Repair Standards

No.	Item	Explanation
34	Sagging	<p>The "sagging" of the film needs repair due to the following causes:</p> <ul style="list-style-type: none"> (1) Spray dust, dust, etc. tend to collect. (2) Sag having a large film thickness. Solvent tends to collect on high film thicknesses. If coating is applied over the "sagging" area, solvent evaporation becomes more difficult leading to possible cracks in the film. <p>"Sagging" to be repaired is as follows:</p> <p>(a) Sagging with the height of 2mm and more.</p>  <p>(b) Wide "sagging"</p>  <p>(c) "Sagging" in the bottom corners</p> 

No.	Item	Explanation
36	Foreign matter	<p>When abrasives are used in surface preparations (blasting), abrasives remaining may adhere to the substrate and be trapped in the film during painting.</p>  <p>Foreign material shall be removed by screen, sanding, etc. as directed by the paint manufacturer.</p>
37	Craters, pinholes, and bubbles	<p>(1) Pinholes tend to occur at the pit of manual welding bead. (2) Craters tend to occur when surface tension becomes uneven during the film drying process. A crater is a concave, and reduces film thickness.</p>  <p>(3) Bubbles occur when paint mixed with air is applied in the airless painting.</p> <p>Repairs to coating to be in accordance with manufacturer recommendations. Generally, surface will be feathered by sanding or screening and coating applied to achieve desired DFT.</p>
39	Blushing	<p>The film will "blush", due to humidity absorbed by the hardening agent. When humidity rises or dew is produced before curing, this may occur. Blushing is confined to the film surface and does not affect film performance. However, excessive blushing must be repaired because it hinders adhesion of overcoating.</p>
40	Mechanical damage	<p>The surface of the film shall be lightly abraded with sandpaper, screen, or as recommended by coating manufacturer and coating applied to the desired DFT.</p> 

VII. Film Thickness Measurement Standards

No.	Item	Explanation
40	Film thickness measurement in tanks.	(1) Measuring equipment to be adjusted once a day by using a reference plate with a thickness nearest to the film thickness to be measured.
41	For other areas see Note.	(2) The measured value of film thickness to be marked at a measuring point using a specified marking material.
43		Film thickness measuring point (x mark)
44		<p>(a) Bottom part</p>  <p>(b) Deck part</p>  <p>NOTE: (For all other areas, measure every 93m² (1,000 ft²) in accordance with SSPC-PA 2)</p>

VIII. Environmental Painting Standards

No.	Item	Explanation
45	Temperature (During painting and drying)	<p>(1) Lowest temperature</p> <p>(a) Temperature must be 3° C or more above the dew point. Theoretically the steel plate surface temperature is used. However the air temperature in tank is practically used herein.</p> <p>(b) Curing of epoxy resin slows down when the temperature drops below 10° C and 5° C is the lowest limit. It is preferable to keep the temperature above 10° C and in conformance with the paint manufacturer's recommendation.</p> <p>(2) Highest temperature</p> <p>The maximum temperature is affected by the type of paint used and the painting process. Consult the paint manufacturer for maximum allowable temperature for application and cure.</p>
46	Humidity (During painting, and initial drying)	<p>Relative humidity is to be below 85% . This value applies when the painted surface temperature is equal to or above the atmospheric temperature.</p>
47	Ventilation	<p>(1) The amount of ventilation required during painting and drying is greater than that required for blasting due to the following reasons:</p> <p>(a) The film begins hardening with evaporation of solvents in the film.</p> <p>(b) Solvent evaporation is greatly influenced by ventilation and temperature.</p> <p>(c) Retained solvents affect film performance.</p> <p>(2) Air change rate</p> <p>This standard is determined for correct film performance and this varies depending on tank capacity. These standards are different from OSHA 29 CFR 1915.35 and OSHA 29 CFR 1926.57. Consult "Industrial Ventilation, 20th Edition"¹ and OSHA Technical Manual Section III: Chapter 3 for guidance.</p> <p>(3) Air change rate for high humidity (85% RH or above). With high humidity, dew must be prevented after painting, from blasting stages up to the film hardening stages. Otherwise, the following may occur:</p> <p>(a) Turning of blasted surfaces</p> <p>(b) Film defects (Blushing, poor adhesion)</p> <p>As described above in (1) insufficient ventilation also deteriorates film performance. Consequently it is preferable to ventilate at least three times per hour even with high humidity for two days (this varies according to the type of paint) immediately after painting.</p>

No.	Item	Explanation
48 58	The safety and Health Standards for Painting	(1) The safety and Health Standards for Painting (a) When gas concentration reaches 10% of the lower explosion limit (LEL), stop operations and evacuate workers. (b) When gas concentration exceeds 10% of the lower explosion limit (LEL), take appropriate measures such as adding fans and reducing the number of paint sprayers. Refer to OSHA 29 CFR 1915.35 and 29 CFR 1926.57 Consult “Industrial Ventilation, 20 th Edition” ¹ OSHA Technical Manual Section III: Chapter 3 for guidance.
45 46 47 48	Instruments for measuring environmental conditions	(1) For humidity and dew point: Sling psychrometer and psychrometric tables or battery operated psychrometer according to ASTM E 337 Standard. (2) Surface temperature Magnetic contact surface thermometer. (3) Anemometer Used to measure the ventilation volume and rate.
49	Erection of scaffoldings	(1) Scaffolding pieces Scaffolding pieces not to be removed are recommended to be of stainless steel. (2) The distance between painted surfaces and scaffolding is to be between 150 and 300 mm (to prevent unpainted portions). (3) Scaffold planks of expanded metal or similar open design to assist in abrasive removal and ventilation. (4) Height of scaffolding; 1,700 to 1,900 mm (to ensure easy and satisfactory work).
50	Illumination	Explosion-proof lighting is to be used during painting and drying.

References

1. Industrial Ventilation, 20th Edition, *A Manual of Recommended Practice*, 1988, Committee on Industrial Ventilation, American Conference of Governmental Hygienists (ACGIH), 6500 Glenway Avenue, Building D-7, Cincinnati, OH 45211

ASQS

REFERENCED STANDARDS

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D4417 Test Methods for Field Measurement of Surface Profile of Blasted Steel

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8502-3 Assessment of Dust on Steel Surfaces prepared for painting (Pressure-Sensitive Tape Method)

ISO 8502-6 Extraction of Soluble Contaminants for Analysis – The Bresle Method

NACE INTERNATIONAL (NACE)

NACE No. 5 Surface Preparation and Cleaning of Steel and Other Hard Materials by High-and Ultrahigh-Pressure Water Jetting Prior to Re-coating (SSPC-SP 12)

NACE No. 7 Interim Guide and Visual Reference Photographs for Steel Cleaned by Water Jetting (SSPC-VIS 4(1))

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC-AB 1 Mineral and Slag Abrasives

SSPC-AB 2 Specification for Cleanliness of Recycled Ferrous Metallic Abrasives

SSPC-PA 2 Measurement of Dry Coating Thickness With Magnetic Gages.

SSPC-SP 1 Solvent Cleaning

SSPC-SP 2 Hand Tool Cleaning

SSPC-SP 3 Power Tool Cleaning

SSPC-SP 7 Brush-Off Blast Cleaning

SSPC-SP 10 Near-White Blast Cleaning

SSPC-SP 11 Power Toll Cleaning to Bare Metal

SSPC-SP 12 Surface Preparation and Cleaning of Steel and Other Hard Materials by High-and Ultrahigh-Pressure Water Jetting Prior to Re-coating (NACE No. 5)

SSPC-VIS 1-89 Visual Standard For Abrasive Blast Cleaned Steel

SSPC-VIS 3 Visual Standard for Power- and Hand- Tool Cleaned Steel

SSPC-VIS 4(1) Interim Guide and Visual Reference Photographs for Steel Cleaned by Water Jetting (NACE No. 7)

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